Advanced Instruments Inc.

Technical Specifications *

Accuracy:	< 2% of FS range under constant conditions
Analysis:	0-1%, 0-5%, 0-10%, 0-25% FS ranges Auto-ranging or manual lock on a single range
Application:	Oxygen analysis in inert, helium, hydrogen, mixed and acid (CO_2) gas streams
Approvals:	CE
Area Classification:	General purpose
Alarms:	Two adjustable form C relay contacts non-latching; "weak sensor" indicator; power failure; system failure
Calibration:	Max interval—3 months. Air calibrate with clean source of certified span gas, compressed, or ambient (20.9% O2) air on 0-25% range.
Compensation:	Barometric pressure and temperature
Connections:	1/4" compression tube fittings
Controls:	Water resistant keypad; menu driven range selection, calibration, alarm and system functions
Data Acquisition:	Selectable data point intervals
Display:	Graphical LCD 5" x 2.75"; resolution .001%; displays real time ambient temperature and pressure
Enclosure:	Painted aluminum 7.5" x 10.8" x 12.25" panel mount
Flow:	Not flow sensitive; recommended flow rate 2 SCFH
Linearity:	> .995 over all ranges
Pressure:	Inlet - regulate to 5-30 psig to deliver 2 SCFH flow; vent - atmospheric
Power:	Universal; specify 100 or 200 VAC for heater system
Range ID:	1-5V; Optional (1) 4-20mA non-isolated OR (2) relay contacts w/ 4-20mA or 1-5V
Response Time:	90% of final FS reading < 10 seconds
Sample System:	Flow indicator and flow control
Sensitivity:	< 0.5% of FS range
Sensor Model:	GPR-11-32-4 for non-acid (CO2) gas streams XLT-11-24-4 for gas mixture with > 0.5% CO_2
Sensor Life:	GPR-11-32-4 32 months in air at 25°C and 1 atm XLT-11-24-4 24 months in air at 25°C and 1 atm
Signal Output:	4-20mA isolated, 0-1V, and 0-5V
Temp. Range:	5°C to 45°C (GPR sensor), -10°C to 45° (XLT sensor)
Warranty:	12 months analyzer; 12 months sensor

Optional Equipment

19" rack, wall mounting, auto zero/cal, remote communication-contact factory

* Specification subject to change without notice.

Advanced Instruments Inc.
ENTER
ESC
GPR-2600
FLOW

GPR-2600
Oxygen Analyzer

Advanced Full Featured Process O2 Analyzer

Advanced Sensor Technology

- Unmatched Performance in O2 Analysis
- Unmatched 32 Month Expected Life
- Sensitivity < 0.5% FS Range
- Extended –10°C Operating Range
- Excellent Compatibility with 0-100% CO2

2 Field Selectable Alarm Setpoints

Auto Ranging or Single Fixed

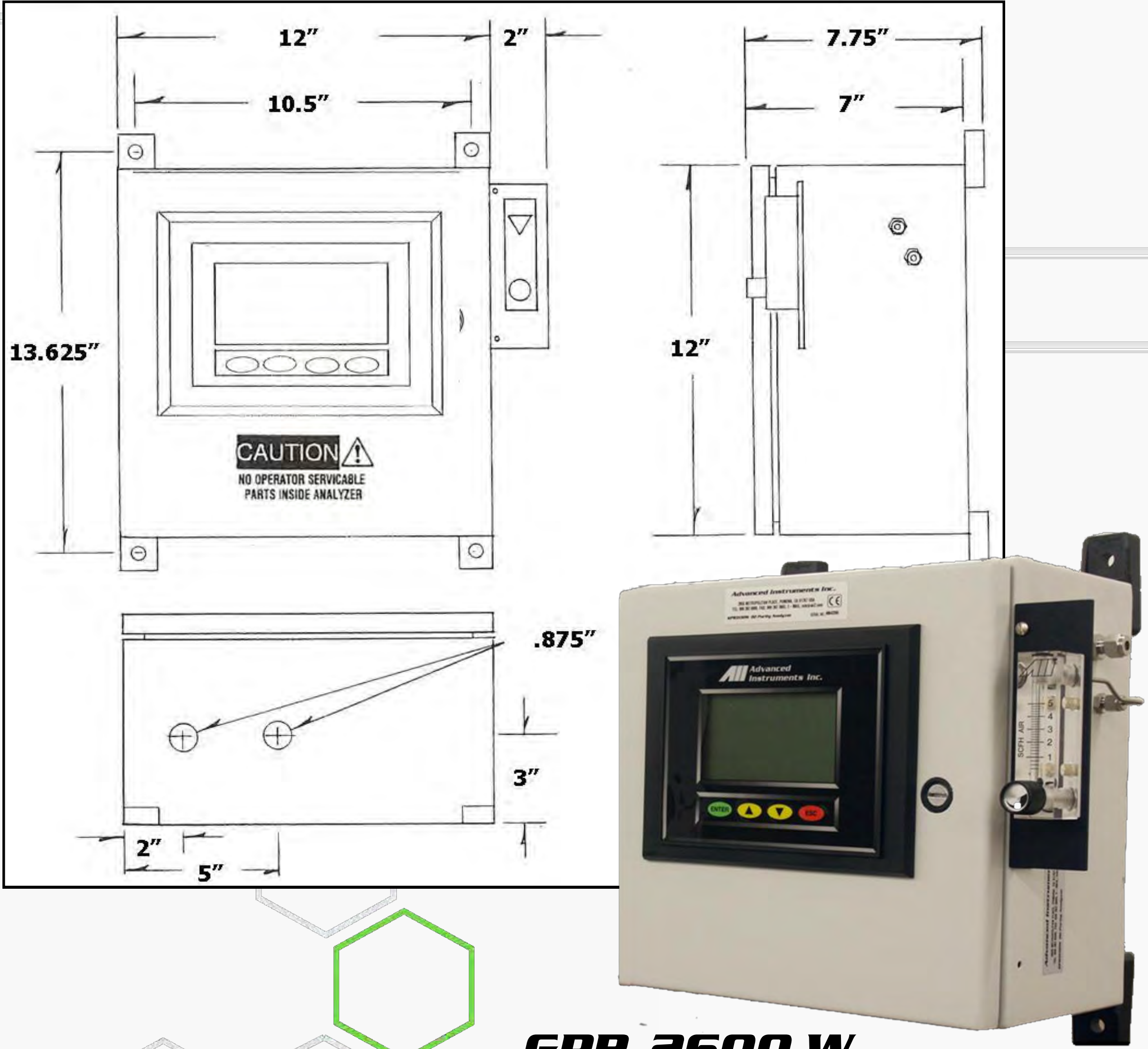
Options: Temperature Control

Auto-Zero and Auto-Cal

Remote Communication via USB, RS232, RS485

ISO 9001:2008 Certified

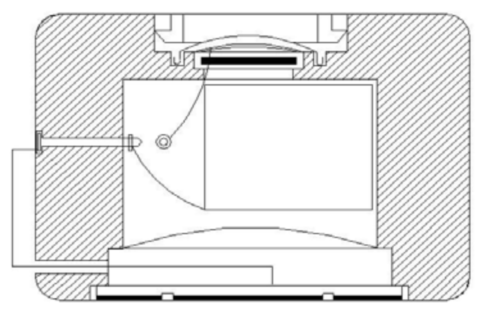
INTERTEK Certificate No. 485



GPR-2600 W

Advanced Sensor Technology

The sensor is the heart of any analyzer, thus sensor technology is the critical factor in analyzer performance. Advanced Instruments focuses on optimizing the sensor to meet specific application needs and has produced the first real advancements in sensor technology in decades. All sensors are manufactured under an independently certified QA system that complies with ISO 9001:2008.



Advancements:

Innovative design, materials
Control O_2 reaction
Proprietary mfg process
Extend operating temperature
Insensitive to vibration
Compact inexpensive design

Performance:

Accuracy < ± 1% FS
Sensitivity 0.5% FS (500 ppm)
Service life up to 10 yrs in air
5ºC (GPR); -10ºC (XLT) to 45ºC
Linear pressure comp to 1 atm
No sensor maintenance

Advanced Instruments Inc.

GPR-2600
% Oxygen Analyzer

Owner's Manual

Revised February 05, 2015

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1. Introduction

Your new oxygen analyzer is a precision piece of equipment designed to give you years of use in a variety of industrial oxygen applications.

This analyzer is designed to measure oxygen concentration in inert gases, gaseous hydrocarbons, hydrogen, and a variety of gas mixtures. In order to derive maximum performance from your new oxygen analyzer, please read and follow the guidelines provided in this Owner's Manual.

The serial number of this analyzer may be found on the inside the analyzer. You should note the serial number in the space provided and retain this Owner's Manual as a permanent record of your purchase, for future reference and for warranty considerations.

Serial Number: ________________________

Every effort has been made to select the most reliable state of the art materials and components designed for superior performance and minimal cost of ownership. This analyzer was tested thoroughly by the manufacturer for best performance. However, modern electronic devices do require service from time to time. The warranty included herein plus a staff of trained professional technicians to quickly service your analyzer is your assurance that we stand behind every analyzer sold.

Advanced Instruments Inc. appreciates your business and pledge to make effort to maintain the highest possible quality standards with respect to product design, manufacturing and service.

2. Quality Control Certification

Date: **Customer:** **Order No.:** **Pass**

Model: GPR-2600 % Oxygen Analyzer **S/N** ______________________

Sensor:
( ) GPR-11-32 PPM Oxygen Sensor
( ) XLT-11-24 PPM Oxygen Sensor **S/N** ______________________

Accessories:
Owner's Manual
CABL-1008 Power Cord
TOOL-1001 5/16" Combination Wrench

Configuration:
Ranges: 0-1%, 0-5%, 0-10%, 0-25%
A-1146-10 PCB Assembly Main / Display **Software V.** ______
( ) A-1146-10 PCB Power Supply / Interconnect, 1-5V Range ID
( ) A-1174-10 PCB Power Supply / Interconnect, 5x Relay Contacts Range ID
( ) Stainless steel sensor housing, manual flow control, 1/4" Tube fittings for sample inlet and vent
( ) Delete sample/bypass valve from above (T and TO options)
( ) Sample, span, zero inlet solenoid valves
( ) Temperature controlled heater system 85°F specify: ( ) 110VAC (X) 220VAC
Power: 100/120/220/250 VAC (universal without temperature controlled heater systems)
Enclosure: (X) Std. panel mount 7.5"x10".8x12"
( ) Bezel for 19" rack mount 19"x12"x12" option
( ) GPR-2600-W option general purpose wall mount 12"x12"x8"
( ) GPR-2600-W306 option general purpose panel mount 18.2"x16"x10"

Test
System start-up diagnostics satisfactory
Auto/manual range
Alarm relays activate/deactivate with changes in O_2 concentration
Alarm bypass
Analog outputs: 0-1 V DC, 0-5 VDC and output 4-20mA
Range ID: (X) 1-5 VDC or ( ) 5x relay contacts plus 1x common

Baseline drift on zero gas < ± 2% FS over 24 hour period
Noise level < ± 1.0% FS
Span calibration gas value
Span adjustment within 10-50% FS
Peak to peak over/under shoot < 0.5% FS
Overall inspection for physical defects

Options

Notes

3. Safety Guidelines

This section summarizes the basic precautions applicable to all analyzers. Additional precautions specific to individual analyzer are contained in the following sections of this manual. To operate the analyzer safely and obtain maximum performance follow the basic guidelines outlined in this Owner's Manual.

⚠ **Caution:** This symbol is used throughout the Owner's Manual to **CAUTION** and alert the user to recommended safety and/or operating guidelines.

⚡ **Danger:** This symbol is used throughout the Owner's Manual to identify sources of immediate **DANGER** such as the presence of hazardous voltages.

Read Instructions: Before operating the analyzer read the instructions.

Retain Instructions: The safety precautions and operating instructions found in the Owner's Manual should be retained for future reference.

Heed Warnings Follow Instructions: Follow all warnings on the analyzer, accessories (if any) and in this Owner's Manual. Observe all precautions and operating instructions. Failure to do so may result in personal injury or damage to the analyzer.
Heat: Situate and store the analyzer away from sources of heat.

Liquid and Object Entry: The analyzer should not be immersed in any liquid. Care should be taken so that liquids are not spilled into and objects do not fall into the inside of the analyzer.

Handling: Do not use force when using the switches and knobs. Before moving your analyzer be sure to disconnect the wiring/power cord and any cables connected to the output terminals located on the analyzer.

Maintenance

Serviceability: Except for replacing the oxygen sensor, there are no parts inside the analyzer for the operator to service.
Only trained personnel with the authorization of their supervisor should conduct maintenance.

Oxygen Sensor: DO NOT open the sensor. The sensor contains a corrosive liquid electrolyte that could be harmful if touched or ingested, refer to the Material Safety Data Sheet contained in this Owner's Manual. Avoid contact with any liquid or crystal type powder in or around the sensor or sensor housing, as either could be a form of electrolyte. Leaking sensors should be disposed of in accordance with local regulations.

Troubleshooting: Consult the guidelines in section 8 for advice on the common operating errors before concluding that your analyzer is faulty. Do not attempt to service the analyzer beyond those means described in this Owner's Manual.

Do not attempt to make repairs by yourself as this will void the warranty, as detailed by section 9, and may result in electrical shock, injury or damage. All other servicing should be referred to qualified service personnel.

Cleaning: The analyzer should be cleaned only as recommended by the manufacturer. Wipe off dust and dirt from the outside of the unit with a soft damp cloth then dry immediately. Do not use solvents or chemicals.

Nonuse Periods: Disconnect the power when the analyzer is left unused for a long period of time.

Installation Consideration

Gas Sample Stream: Ensure the gas stream composition of the application is consistent with the specifications of the analyzer/sensor and review the application conditions before initiating the installation. Consult factory to ensure the sample is suitable for analysis.

Expected Sensor Life

With reference to the publish specification located in section 4 of this manual, the expected life of sensor is predicated on the basis of oxygen concentration at 21%,, temperature (77°F/25°C) and pressure (1 atmosphere). As a rule of thumb sensor life is inversely proportional to changes in these parameters.

Materials

Assemble the necessary zero, sample and span gases and optional components such as valves, coalescing or particulate filters, and pumps as dictated by the application; stainless steel tubing is essential for maintaining the integrity of the gas stream of low %O2 (<0.05%) measurements.

Operating Temperature

The sample must be sufficiently cooled before it enters the analyzer and any optional components. A coiled 10 foot length of ¼" stainless steel tubing is sufficient for cooling sample gases as high as 1,800ºF to ambient. The maximum recommended operating temperature is 45º C. On an intermittent basis, unless the user is willing to accept a reduction in expected sensor life – refer to analyzer specification, the analyzer may be operated at 50 degree ^{o}C. At temperatures above 25°C, the user can expect a reduction in sensor life of ~ 2.5% per degree increase in temperature. As an example, if the analyzer is continuously operated at 35°C, the expected sensor life will be reduced by ~25%.

Pressure and Flow

All electrochemical oxygen sensors respond to partial pressure changes in oxygen in a gas stream.
A sample system and flowing gas samples are generally required for applications involving oxygen measurements in a gas mixture.

To analyze a gas stream, the gas must flow or be drawn through the sensor housing. The internal sample system of the analyzer may include a flow control (please check the QC sheet to ensure the included sample system), a flow indicator and al sensor housing with an o-ring seal.

Inlet Pressure

Analyzers designed for flowing samples under positive pressure requires sample pressure between 5-30 PSIG. This pressure range is recommended for ease in controlling the sample flow with the integral flow control valve. Sample pressure up to 100 PSIG is acceptable but will cause difficulty in setting the flow rate.

Outlet Pressure

In positive sample pressure applications, the sample must be vented to ambient air or in a vent with pressure less than 40 inches of water.

⚠ If the sample is vented to a line at pressure above ambient, a back pressure regulated set at no greater 1-2 PSIG must be installed on the downstream of the sensor to ensure a constant pressure on the sensor.

Flow Rate

Flow rates of 1-5 SCFH cause no appreciable change in the oxygen reading. However, flow rates above 5 SCFH may generate a backpressure on the sensor and cause erroneous oxygen readings. A flow rate of 2 SCFH or 1 liter per minute is recommended for optimum performance.

Recommendations to avoid erroneous oxygen readings and damaging the sensor

1. Do not place your finger over the vent (it pressurizes the sensor) to test the flow indicator when gas is flowing to the sensor. Removing your finger (the restriction) generates a vacuum on the sensor and may damage the sensor.
2. Assure there are no restrictions in the sample or vent lines.
3. Avoid excessive flow rate, flow rate above 5 SCFH may generate backpressure on the sensor.
4. Avoid sudden releases of backpressure that can severely damage the sensor.
5. Avoid the collection of liquids or particulates on the sensor, they block the diffusion of oxygen into the sensor - wipe away any liquid and particulate with a damped cloth only.

Moisture & Particulates

Installation of a suitable coalescing and/or particulate filter is required to remove liquid condensates, and/or particulates from the sample gas to prevent clogging of the sampling system. Moisture and/or particulates do not necessarily damage the sensor itself but collection of moisture/particulate on the sensing surface can block or inhibit the diffusion of sample gas into the sensor thus resulting in a reduction of sensor signal output – and the appearance of a sensor failure. Consult factory for recommendations concerning the proper selection of coalescing/particulate filters.

Mounting

The standard analyzer is approved for indoor use only. Outdoor use requires optional enclosures, consult factory. Mount analyzer as recommended in this manual.

The analyzer is configured for panel mounting and requires a 7.5x10.8" cutout with 4 holes for the analyzer's front panel. Optional configurations include a panel mount with 7.75x7.75" cutout; 19" bezel for rack mounting, 12x12x8" wall mount enclosure (GPR-2600W).

Gas Connections

Sample Inlet and Sample Vent gas lines require 1/8" or ¼" stainless steel compression fittings connection; hard plastic tubing with a low gas permeability factor may be used for measurements of oxygen above 0.1%.

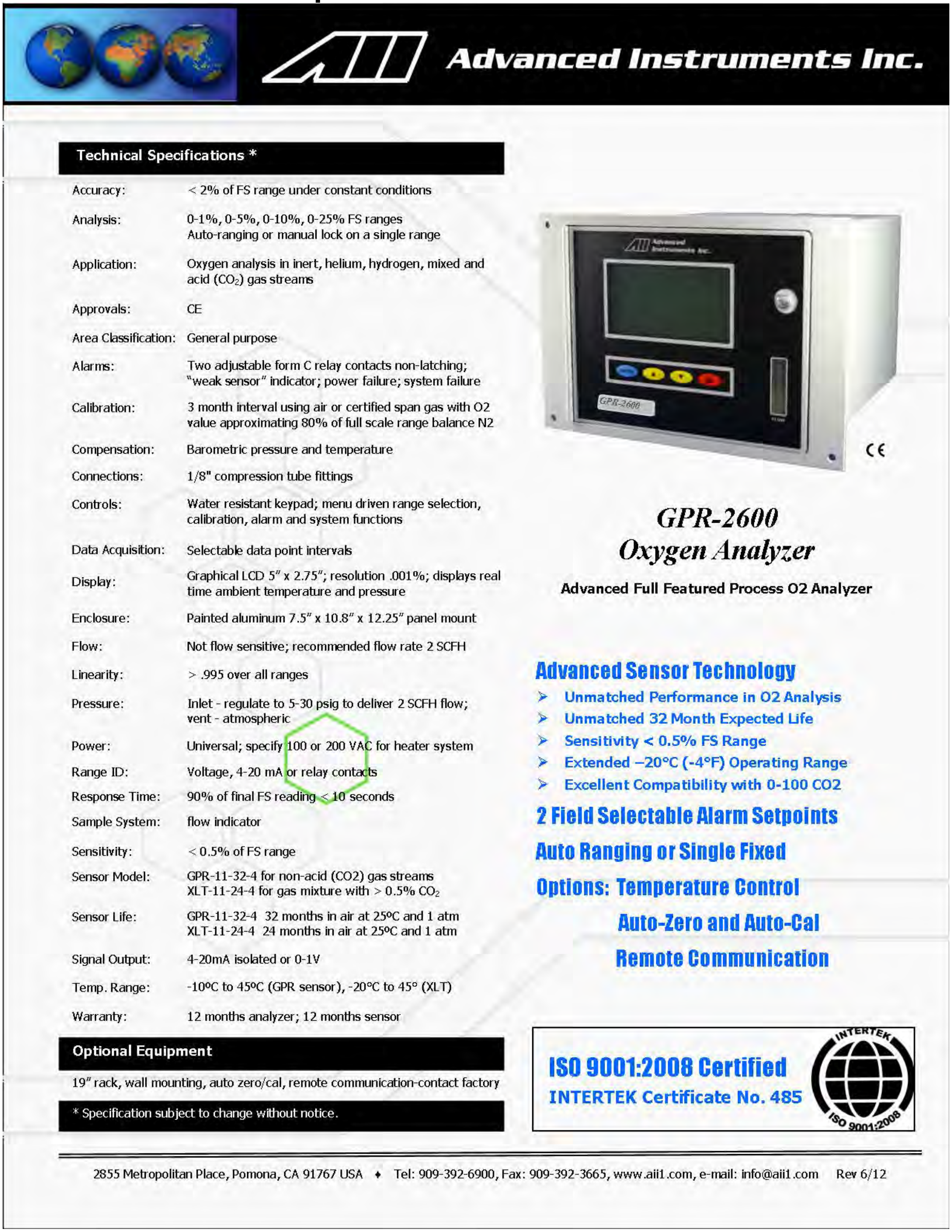
Power

Supply power to the analyzer only as rated by the specification or markings on the analyzer enclosure. The wiring that connects the analyzer to the power source should be installed in accordance with recognized electrical standards. Ensure that the analyzer enclosure is properly grounded and meets the requirements of recommended local electrical standards.

Never yank wiring to remove it from a terminal connection.

Analyzers consume a maximum of 30 watts, without the optional heaters. With optional 110 VAC or 220 VAC heaters installed, the maximum power consumption is 230 watts.

4. Features & Specifications



Advanced Instruments Inc.

Technical Specifications *

Accuracy:	< 2% of FS range under constant conditions
Analysis:	0-1%, 0-5%, 0-10%, 0-25% FS ranges Auto-ranging or manual lock on a single range
Application:	Oxygen analysis in inert, helium, hydrogen, mixed and acid (CO_2) gas streams
Approvals:	CE
Area Classification:	General purpose
Alarms:	Two adjustable form C relay contacts non-latching; "weak sensor" indicator; power failure; system failure
Calibration:	3 month interval using air or certified span gas with O2 value approximating 80% of full scale range balance N2
Compensation:	Barometric pressure and temperature
Connections:	1/8" compression tube fittings
Controls:	Water resistant keypad; menu driven range selection, calibration, alarm and system functions
Data Acquisition:	Selectable data point intervals
Display:	Graphical LCD 5" x 2.75"; resolution .001%; displays real time ambient temperature and pressure
Enclosure:	Painted aluminum 7.5" x 10.8" x 12.25" panel mount
Flow:	Not flow sensitive; recommended flow rate 2 SCFH
Linearity:	> .995 over all ranges
Pressure:	Inlet - regulate to 5-30 psig to deliver 2 SCFH flow; vent - atmospheric
Power:	Universal; specify 100 or 200 VAC for heater system
Range ID:	Voltage, 4-20 mA or relay contacts
Response Time:	90% of final FS reading < 10 seconds
Sample System:	flow indicator
Sensitivity:	< 0.5% of FS range
Sensor Model:	GPR-11-32-4 for non-acid (CO2) gas streams XLT-11-24-4 for gas mixture with > 0.5% CO_2
Sensor Life:	GPR-11-32-4 32 months in air at 25°C and 1 atm XLT-11-24-4 24 months in air at 25°C and 1 atm
Signal Output:	4-20mA isolated or 0-1V
Temp. Range:	-10°C to 45°C (GPR sensor), -20°C to 45° (XLT)
Warranty:	12 months analyzer; 12 months sensor

Optional Equipment

19" rack, wall mounting, auto zero/cal, remote communication-contact factory

* Specification subject to change without notice.

CE

GPR-2600
Oxygen Analyzer

Advanced Full Featured Process O2 Analyzer

Advanced Sensor Technology

- Unmatched Performance in O2 Analysis
- Unmatched 32 Month Expected Life
- Sensitivity < 0.5% FS Range
- Extended –20°C (-4°F) Operating Range
- Excellent Compatibility with 0-100 CO2

2 Field Selectable Alarm Setpoints

Auto Ranging or Single Fixed

Options: Temperature Control

Auto-Zero and Auto-Cal

Remote Communication

ISO 9001:2008 Certified

INTERTEK Certificate No. 485

2855 Metropolitan Place, Pomona, CA 91767 USA ♦ Tel: 909-392-6900, Fax: 909-392-3665, www.aii1.com, e-mail: info@aii1.com Rev 6/12

5. Operation

5. Operation

Principle of Operation

The GPR-2600 Oxygen Analyzers incorporates a variety of % range advanced galvanic fuel cell type sensors. The analyzer is configured for panel mounting and requires a 7.5"x10.8" cutout with 4 holes for the analyzer's front panel. Optional configuration; 19" bezel for rack mounting, 12"x12"x8" wall mount enclosure (GPR-2600W), 18.2"x16"x10" panel mount configuration (GPR-2600W-306) using the wall mount enclosure. Contact the factory for additional information on options. All configurations are tested and calibrated by the manufacturer prior to shipment.

The GPR-2600 series analyzers and sensors conform to CE standards and are manufactured under a Quality Assurance System, certified by an independent agency, in accordance with ISO 9001:2008 standards.

Advance Galvanic Sensor Technology

All galvanic sensors function on the same principle and are specific to oxygen. They measure the partial pressure of oxygen ranging from low PPM to 100% levels in inert gases, gaseous hydrocarbons, helium, hydrogen, mixed gases and acid gas streams. **Oxygen, the fuel for this electrochemical transducer, diffuses into the sensor and reacts chemically at the sensing electrode to produce an electrical current output proportional to the oxygen concentration in the gas phase.** The sensor's signal output is linear over all measuring ranges and remains virtually constant over its useful life. The sensor requires no maintenance and is easily and safely replaced at the end of its useful life.

Electronics

The signal generated by the sensor is processed by state of the art low powered micro-processor based digital circuitry. The first stage amplifies and converts the electrical current into voltage signal. The second stage eliminates the low frequency noise. The third stage employs a high frequency filter and compensates for the sensor's signal output variations caused by ambient temperature variations. The result is a very stable sensor signal.

Sensor's response time of 90% of a "step change" is less than 10-30 seconds (actual experience may vary due to the integrity of sample line connections, dead volume and flow rate selected) on all ranges under ambient monitoring conditions. Sensitivity is typically 0.5% of full scale of the lowest range of analysis.

Additional features of the micro-processor based electronics include manual or auto ranging, auto-zero and auto-cal, isolated 4-20mA signal for signal output, optional 4-20 mA as range ID, separate relay contacts rated 30 VDC max @ 1A or 110/220 VAC @ 5A are provided for the alarm feature. Optional range ID contacts are rated at 30 VDC @1A.

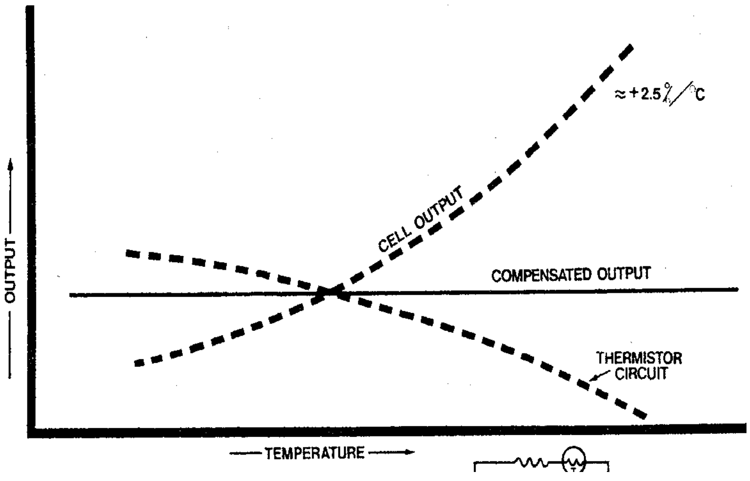
Whenever the analyzer is span calibrated, a unique algorithm predicts and displays a message indicating a 'weak sensor' (if the sensor output has fallen below a certain level), suggesting the sensor be replaced in the near future.

Sample System

For accurate measurements, the sample gas must be properly presented to the sensor. In standard form, the GPR-2600 is equipped with a sample system that complements the performance capabilities of the advanced oxygen sensor. The sample system includes a flow meter and or flow meter with flow control valve

Advanced Instruments Inc. offers a full line of sample handling, conditioning and expertise to meet your application requirements. Contact us at 909-392-6900 or e-mail us at info@aii1.com for your specific requirements.

Accuracy Overview



Single Point Calibration: As previously described the galvanic oxygen sensor generates an electrical current proportional to the oxygen concentration in the sample gas. In the absence of oxygen the sensor exhibits an absolute zero, e.g. the sensor does not generate a current output in the absence of oxygen. Given the linearity and absolute zero properties, single point calibration is possible.

Pressure: Because sensors are sensitive to the partial pressure of oxygen in the sample gas, their output is a function of the number of molecules of oxygen 'per unit volume'. For best accuracy, the pressure of the sample gas and that of the calibration gas must be the same (in reality within 2-5 psi) so that when the SAMPLE/SPAN gases are switched, the gas flow rate would not drastically change.

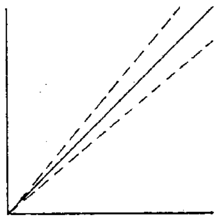
Temperature: The rate at which oxygen molecules diffuse into the sensor is controlled by a Teflon membrane otherwise known as an 'oxygen diffusion limiting barrier. The fact that all diffusion processes are temperature sensitive, the sensor's electrical output also varies with temperature. This variation is relatively constant (2.5% per °C change in temperature). A temperature compensation circuit employing a thermistor offsets this effect with an accuracy of ±5% or better (over the operating temperature range of the analyzer) and generates an output signal that is virtually independent of small ambient temperature variation. To minimize error in oxygen measurement, the calibration of the analyzer should be carried out as close as possible to the temperature during sampling. A small temperature variation of ~10° F will produce < 2% error.

Accuracy: In light of the above parameters, the overall accuracy of an analyzer is affected by two factors:

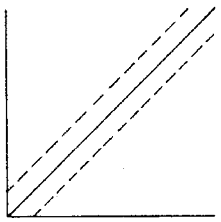
1) 'Percent of reading errors', illustrated by Graph A below, such as ±5% inherited error in the temperature compensation circuit due to the tolerances of the resistors and thermistor.

2) 'Percent of full scale errors', illustrated by Graph B, such as ±1-2% linearity errors generally associated with tolerances in the electronic components, which are really minimal due to today's technology and the fact that other errors are 'spanned out' during calibration.

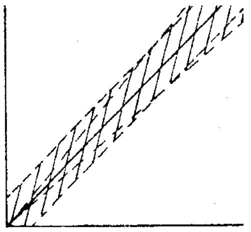
Graph C illustrates these 'worse case' specifications that are typically used to develop an analyzer's overall accuracy statement of < 1% of full scale at constant temperature or < 5% over the operating temperature range. QC testing is typically < 1% prior to shipment.



A. PERCENT OF READING ERRORS



B. PERCENT OF FULL SCALE ERRORS



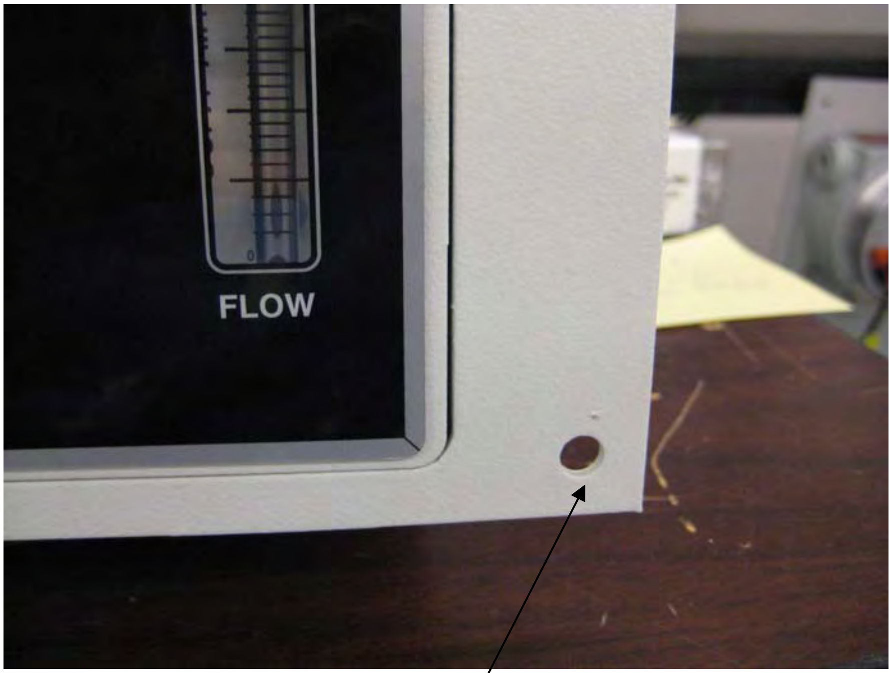
C. OVERALL ACCURACY

Example 1: As illustrated by Graph A any error during a span adjustment, e.g., at 20.9% (air) of full scale range would be multiplied by a factor of 4.78 (100/20.9) when used for measurements of 95-100% oxygen concentrations. Conversely, an error during span adjustment at 100% of full scale range will be reduced proportionately for measurements of lower oxygen concentrations. Refer to the Calibration section for additional details.

Mounting the Analyzer

The standard GPR-2600 is designed to be panel mounted and requires a cutout that accommodates the enclosure and 4 mounting bolts. The design also lends itself to 19” rack mounting with an optional bezel or wall mount enclosures as illustrated below.

1. The standard GPR-2600 is designed for panel mounting directly to any flat vertical surface, wall or bulkhead plate with the appropriate cut out and four ¼” diameter holes for insertion of the mounting studs through the front mounting bezel.
2. When mounting the analyzer, position it approximately 5 feet above the floor for better viewing purposes and easy access to various functions of the analyzer. Leave sufficient room for access to the terminal connections at the rear of the enclosure.
3. **Note:** The proximity of the analyzer to the sample point and use of optional sample conditioning components, such as a sample cooling coil, a coalescing filter and or a particulate filter may have an impact on sample lag time and hence the analyzer response time.



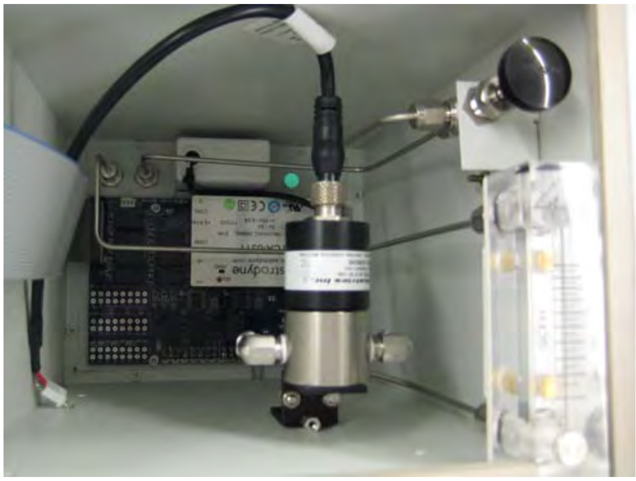
Four mounting holes on four corners to secure analyzer on a flat vertical surface

Gas Connections

The GPR-2600 with its standard flow through configuration is designed for positive sample pressure and requires ¼" compression type connections for incoming sample and outgoing vent lines.

The user is responsible for providing calibration gases and other optional components (if not purchased with the analyzer).

Flow Control Valve: A flow control valve is mounted upstream of the sensor and provides means of controlling the flow rate of the sample gas. Sample flow rate of 1-5 SCFH cause no appreciable change in the oxygen reading. However, for optimum performance, a flow rate of 1-2 SCFH is recommended.



Analyzer with SS sensor housing, Flow control valve and Flow Meter

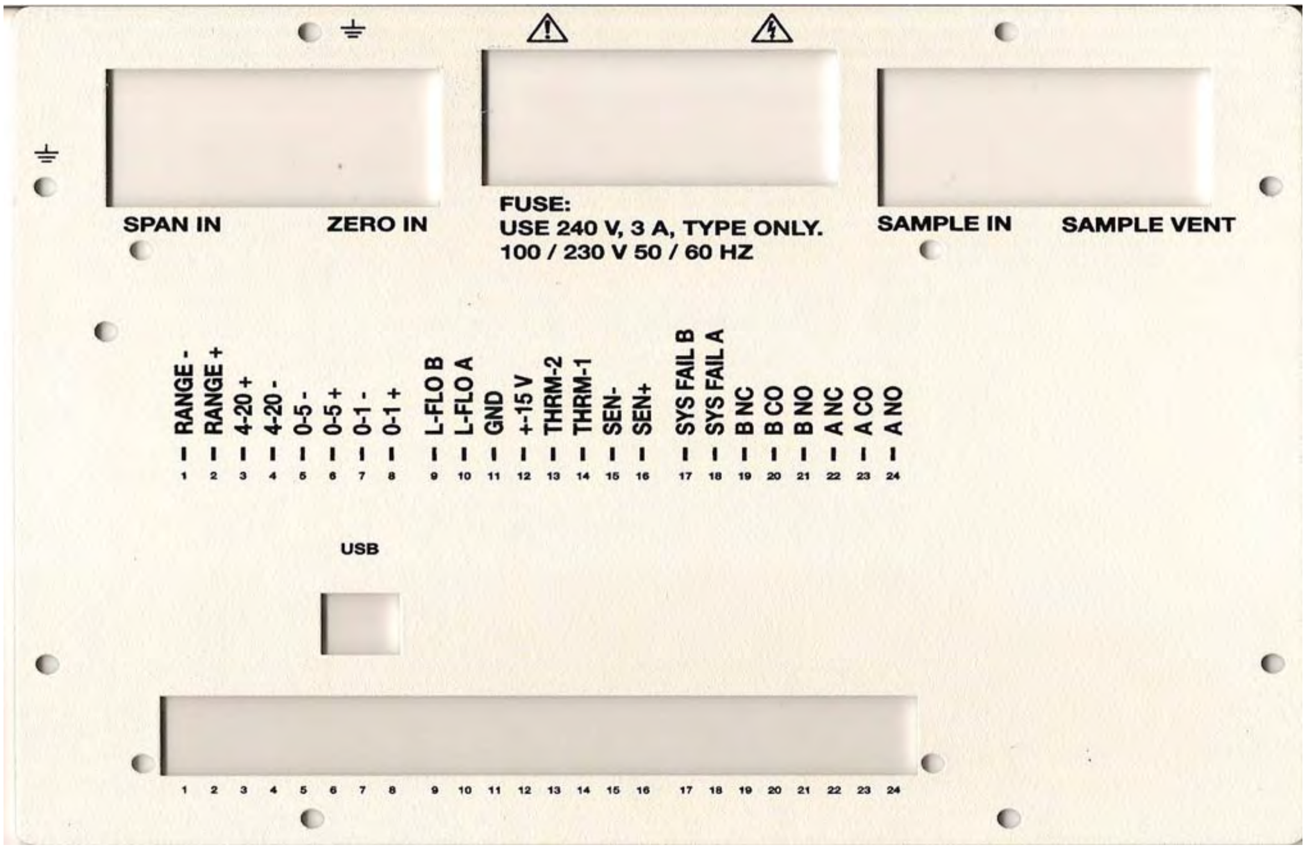
Electrical Connections

Incoming power for the 100-250V AC powered analyzers is supplied through a universal power entry module. A standard computer type power cord (Part# A-1008) is required for the universal power entry module. A well grounded insulated power cable is recommended to avoid noise resulting from unwanted interference.

The appropriate AC power supply (110V or 220V) must specified be specified at order placement if the analyzer is to be equipped with a temperature controlled heater system.

Power consumption is approximately 30 watts without optional heater and 150-200 watts with the heater system.

Caution: Integral 4-20mA converters are internally powered and do not require external power. DO NOT supply any voltage to any of the terminals of the 4-20 mA signal output or the 4-20 mA range ID. If a power is supplied, the 4-20 mA chip can be permanently damaged.


SPAN IN
ZERO IN
FUSE:
USE 240 V, 3 A, TYPE ONLY.
100 / 230 V 50 / 60 HZ
SAMPLE IN
SAMPLE VENT
RANGE -
RANGE +
4-20 +
4-20 -
0-5 -
0-5 +
0-1 -
0-1 +
L-FLO B
L-FLO A
GND
+-15 V
THRM-2
THRM-1
SEN-
SEN+
SYS FAIL B
SYS FAIL A
B NC
B CO
B NO
A NC
A CO
A NO
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
USB
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24

Optional Range ID

The standard 1-5 VDC output is provided for range identification, as described below. An optional 4-20 mA or 5 independent relay contacts representing 5 ranges available as well. Check the QC certificate to verify the option(s). The appropriate relay contact will close when a specific range is selected. The dry contacts are rated at 30VDC @ 1A.

The voltage or 4-20 mA Range ID; Range 1= 5V or 20 mA
Range 2 = 4V or 16 mA
Range 3 = 3V or 12 mA
Range 4 = 2V or 8 mA
Range 5 = 1V 0r 4 mA

Procedure for making connections

1. As illustrated above the alarm relays and signal output connections are hard wired to push-open type terminal blocks located at the rear of the analyzer.
2. Use a small bladed screwdriver to push the lever down and insert the stripped end of the wire into the slot. **NOTE:** Strip insulation of the wires no more than 3/16 inch in length.
3. Insert the stripped end of the cables into the appropriate terminal slots assuring no bare wire remains exposed that could come in contact with the back panel of the analyzer enclosure.
4. Release the lever to secure the wires in the receptacle.
5. To connect to an active relay or “fail safe”, connect the live cable to the common terminal C and the secondary cable to the normally open NO terminal.
6. To break the connection upon relay activation, connect the secondary cable to the normally closed NC terminal.

Danger: While connecting the cables to the relay terminals, ensure there is no voltage on the cables to prevent electric shock and possible damage to the analyzer.

Caution: Assure the stripped wire ends of the cable are fully inserted into the terminal slots and do not touch each other or the back panel of the analyzer enclosure.

Oxygen Level Alarms

The analyzer is configured with two user adjustable threshold type alarm relays that can be configured in the field from the ALARM option on the MAIN MENU as follows:

1. Establish independent alarm set points
2. Either Hi or Lo oxygen condition
3. Either On or Off (enabled or disabled)

Both alarms may be temporarily defeated using a user entered ‘timeout’ period (normally in minutes)

The alarm set point represents an oxygen value. When the oxygen reading exceeds (high alarm) or falls below (low alarm) the alarm set point, the relay is activated and the LCD displays the alarm condition.

When activated, the alarm function triggers the corresponding SPDT Form C non-latching relay rated @ 5A, 30VDC or 240VAC resistive. To prevent chattering of the relays, a 2% hysteresis is added to the alarm set point. This means that the alarm will remain active until the oxygen reading has fallen 2% below the alarm set point (high alarm) or risen 2% above the alarm set point (low alarm) after the alarm was activated. The timeout feature is useful while replacing the oxygen sensor or during calibration when the oxygen reading might well rise above the alarm set point and trigger a false alarm.

Note: When making connections the user must decide whether to configure/connect Alarm 1 and Alarm 2 in failsafe mode (Normally Open – NO – where the alarm relay de-energizes and closes in an alarm condition) or non-failsafe mode (Normally Closed – NC – where alarm relay energizes and opens in an alarm condition).

Power/System Failure Alarm

A dry contact rated at 30VDC @ 1A is provided as a power/system failure alarm that activates when power supplied to the analyzer’s circuits is interrupted. The contact is normally closed but opens when the power to the analyzer is switched off or interrupted. The power fail alarm cannot be disabled.

0-1 VDC, 0-5 VDC and 4-20 mA Signal Output

The analyzer provides 0-1 VDC and 4-20mA full scale signal. The integral IC on the main PCB provides 4-20mA fully isolated signals for output and optional 4-20 mA range ID. This IC does not require any external power.

Range ID

The standard range ID is designated with a voltage output corresponding to a specific range. For example, 5V corresponds to the least sensitive range (25% on the GPR-2600 analyzer) and drops 1V for each additional range.

Optional 4-20 mA signal as range ID is also available. With 4-20 mA range ID option, 20mA represents the least sensitive range and it drops by 4mA (16mA, 12mA, 8mA, 4mA) for each additional range. Please check the QC sheet to confirm the range ID option ordered.

Relay contacts associated with each range may also be provided as range ID. With relay contacts as range ID, the common pin of all relays is connected to the terminal marked COMM and five (5) normally open relay contacts that close when the related range is active. The dry contacts are rated at 30VDC @ 1A.

Caution: The integral 4-20mA converters are internally powered and do not require external power. Applying any external voltage will permanently damage the 4-20mA converter.

Loss of Flow Alarm

The analyzer may be equipped with an optional integral loss of flow/low flow alarm. The alarm is set at 1.5 SCFH. The contact will close when the gas flow exceeds 1.5 SCFH but will open when the gas flow falls below 1.5 SCFH. The set point is relatively rough, therefore, to prevent false alarm, set the gas flow rate above 2 SCFH. Check the QC certificate to verify whether this option is available with your analyzer.

The contact is rated at 1A@30 VDC. Do not exceed the recommended rating.

Temperature Controlled Heater System with Thermal Runaway Protection

The standard GPR-2600 Series analyzer is generally not equipped with the heater system. However, in anticipation of very low % (less than 0.01 %) oxygen analysis, the user may elect to add the heater system. This unit is a PID controller which operates between 0-99°F. At the factory the controller is programmed to maintain the temperature at 85°F.

SV
C1
C2
AL1
AL2
85.0
°F
SEL

Caution: Do not change this setting. A higher temperature setting may drastically reduce sensor life and possibly cause damage to the electronic circuitry of both the controller and the analyzer.

Warning: Keep the front door securely fastened and closed when the temperature controller is ON.

When power is applied to the temperature controller, the controller tunes itself to eliminate and/or minimize the over/under shoot of temperature from the set point. It is recommended that at initial start-up, when replacing the oxygen sensor or when trouble shooting, turn off the power to the heater (by setting the temperature set point at 60°F to prevent overheating the analyzer). When operating the analyzer under normal conditions, set the temperature controller at 85ºF.

Changing the display value from °F to °C:

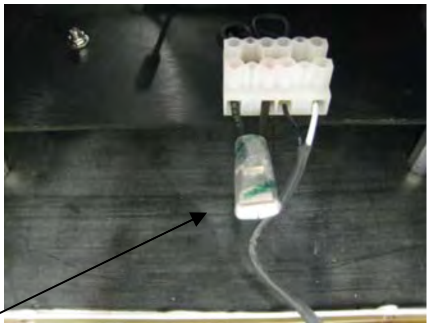
1. Push the UP ARROW and ENTER buttons down for 5 seconds to access the SECURE MENU
2. Press INDEX to advance to the F-C MENU
3. Select °C or °F by pressing the UP ARROW key
4. Press the ENTER key when F-C starts flashing on the display
5. Press INDEX to exit the SECURE MENU

Heater Runaway Protection

Part of the optional temperature controlled heater system is a heater runaway protection circuit that protects the electronics in the event the temperature controller should fail and thereby allowing the heater to runaway damaging the components inside the analyzer.

The runaway protection is provided by a J2 type device positioned between the temperature controller and the heater. This device cuts-off power to the heater if the temperature inside the analyzer exceeds 70°C. Should the J2 device cut power to the heater, correct the problem and reset the runaway protector device (J2 will conduct under normal conditions) by exposing it to 0°C for a few minutes (a refrigerator freezer will do). NOTE, should the J2 fail to reset itself, replace it.

To access the J2, remove the back cover of the analyzer. The j2 is mounted on a white terminal block as shown in the figure above.



Installing a new Oxygen Sensor

The analyzer is equipped with an internal oxygen sensor that has been tested and calibrated by the manufacturer prior to shipment and is fully operational from the shipping containers. The sensor has been installed at the factory. However, it may be necessary to install the sensor in the field.

Caution: DO NOT open/dissect the sensor. The sensor contains a corrosive liquid electrolyte that could be harmful if touched or ingested, refer to the Material Safety Data Sheet contained in the Owner's Manual appendix. Avoid contact with any liquid or crystal type powder in or around the sensor or sensor housing, as either could be a form of electrolyte. Leaking sensors should be disposed of in manner similar to that of a common battery in accordance with local regulations.

Oxygen screws in to a SS or Delrin flow through sensor housing. Screw sensor only finger tight.

Establishing Power to the Electronics

Once the power to the electronics is established, the digital display responds instantaneously. When power is applied, the analyzer performs several diagnostic system status checks termed “SYSTEM SELF TEST” as illustrated below:

```
System Self Test
CPU                 OK
Memory              OK
RTC                 OK
Analog              OK
```

```
GPR Series Oxygen Analyzer
   Software Version X.XX
   Advanced Instruments
   2855 Metropolitan Place
   Pomona, CA 91767
   Tel:  909-392-6900
   Fax:  909-392-3665
   e-mail:  info@aii1.com
```

After 3 seconds the system defaults to the STANDBY mode and the LCD displays the following:

```
* MAIN MENU           Standby
  Sample
  Span
  Zero
  Alarm
  System
  Standby


Auto Range
85ºF      100Kpa      12/31/07      12:00:00
```

Menu Format

Following selections are available from the main Menu

- Menu selected – displayed on the top line in the upper left corner of the display.
- Menu options available – all menus displayed on the left side of the LCD.
- Menu option selected - indicated by the cursor (*) positioned to the left of the menu option selected.
- System mode - indicated at the top center of the display.

- Range mode and current auto or fixed manual range - displayed on the first line at the bottom of the display.
- Temperature inside of the analyzer and ambient pressure - displayed on the second line at the bottom of the screen.

Note: In the event power to the analyzer is interrupted, the system defaults to the “Standby” mode when power is restored. To resume sampling, advance the cursor (*) to “Sample” mode, press ENTER to select and select the range mode as described below.

Menu Navigation

The four (4) pushbuttons located on the front of the analyzer control the system Menus

Green - ENTER (select)
Yellow UP ARROW – advance cursor up
Yellow DOWN ARROW – advance cursor down
Red – ESC (menu)

Select the Menu option by advancing cursor (*) by repeatedly pressing the yellow UP/DOWN ARROW keys.

Accept the Menu option selected with cursor (*) by pressing the green ENTER key.

Abort the Menu option selected with cursor (*) and return to the previous menu by pressing the red ESC key.

NOTE: If a selection is not made within 30 sec, the analyzer will return to Sample Mode.

Range Mode Selection

Advance the cursor (*) to the “Sample” option as illustrated and press the green ENTER key to accept the selection.

```
  MAIN MENU          Standby

* Sample
  Span
  Zero
  Alarm
  System
  Standby



Auto Range
85ºF      100Kpa     12/31/2011      12:00:00
```

The following menu appears:

```
* SAMPLE             Standby

  Auto Range
  Manual Range
  Bypass
  Standby




Auto Range
85ºF      100Kpa     12/31/2011      12:00:00
```

The analyzer is equipped with four (4) standard measuring ranges (see specification) and provides users with a choice of sampling modes. By accessing the MAIN MENU, users may select either the Auto Range or a fixed Manual Range mode.

Auto Range Sampling

In the Auto Range mode, the analyzer will automatically select the appropriate full scale range depending on the concentration of oxygen in a sample gas. The display will shift to the next higher range when the oxygen reading exceeds 99.9% of the current range. The display will shift to the next lower range when the oxygen reading drops to 85% of the next lower range.

For example, if the analyzer is reading 1% on the 0-10 % range and an upset occurs, the display will shift to the 0-25% range when the oxygen reading exceeds 10%. Conversely, once the upset condition is corrected, the display will shift back to the 0-10% range when the oxygen reading drops to 8.5%.

Procedure: From the SAMPLE menu, advance the cursor (*) to the “Auto Range” option and press ENTER:

```
 SAMPLE                  Standby

* Auto Range
  Manual Range
  Bypass
  Standby




Auto Range
85ºF      100Kpa     12/31/2011      12:00:00
```

Note: For an optional automated Sample System, the system displays a message "Opening Sample Valve". This message does not apply to analyzers equipped with standard manually operated Sample System.

Similarly, the Bypass and Standby modes do not apply to analyzers equipped with manual Sample System

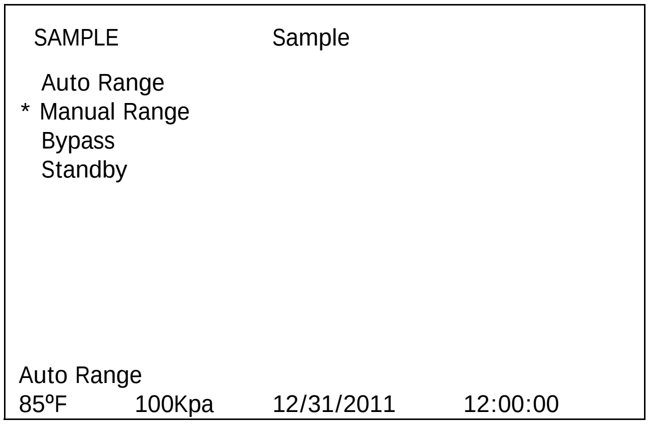
Within seconds the system assesses the oxygen concentration, selects the appropriate range (as described above) and returns to the MAIN MENU in the “Sample” mode. On the second line from the bottom of the menu screen, the Auto Range mode is indicated along with the current full scale range.

```
* MAIN MENU              Sample

  Sample
  Span
  Zero                   5.00 %
  Alarm
  System
  Standby



Auto Range               0 to 10 %
85ºF      100Kpa         12/31/2011      12:00:00
```

Manual Range Sampling

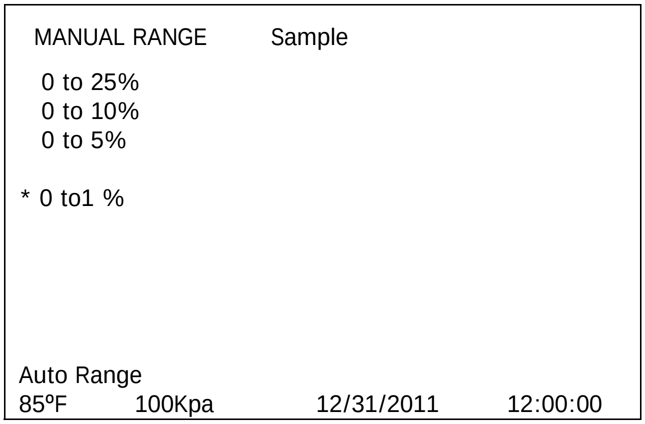
In the manual range mode, the display will not shift automatically. Instead, when the oxygen reading exceeds 125% of the upper limit of the current range, an” OVER RANGE” warning will be displayed. Once the OVER RANGE warning appears the user must advance the analyzer to the next higher range.

Procedure: From the SAMPLE menu, advance the cursor (*) to the “Manual Range” option and press ENTER:



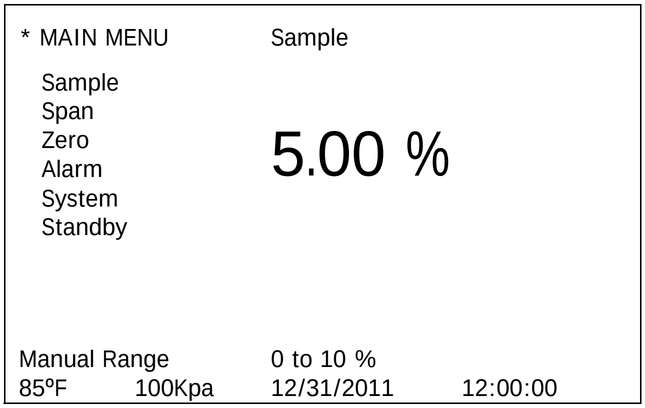
```
 SAMPLE                Sample

  Auto Range
* Manual Range
  Bypass
  Standby





Auto Range
85ºF      100Kpa      12/31/2011      12:00:00
```

The following display appears:



```
 MANUAL RANGE          Sample

  0 to 25%
  0 to 10%
  0 to 5%

* 0 to1 %




Auto Range
85ºF      100Kpa          12/31/2011      12:00:00
```

Advance the cursor (*) to the desired fixed manual range, e.g. 0 to 1% and press ENTER.
Within seconds the system assesses the oxygen concentration and returns to the MAIN MENU in the “Sample” mode. On the second line at the bottom of the menu, the Manual Range mode is indicated along with the fixed full scale range selected



```
* MAIN MENU            Sample

  Sample
  Span
  Zero                 5.00 %
  Alarm
  System
  Standby



Manual Range           0 to 10 %
85ºF      100Kpa       12/31/2011      12:00:00
```

If the oxygen reading exceeds 125% of the full scale fixed range manually selected, the system displays the following message, e.g., on 0-10 % range:

```
* MAIN MENU         Sample
  Sample
  Span
  Zero
  Alarm             12.50 %
  System
  Standby              OVER RANGE



Manual Range        0 to 10 %
85ºF      100Kpa    12/31/2011      12:00:00
```

Setting Alarms

The analyzer is configured with two user adjustable threshold type alarm relays that can be configured in the field from the ALARM option on the MAIN MENU as follows:

- Establish independent oxygen set points
- Either Hi or Lo
- Either On or Off (enabled or disabled)
- Both temporarily defeated using a user entered ‘timeout’ period (normally a few minutes)

The alarm set point represents a value. When the oxygen reading exceeds (high alarm) or falls below (low alarm) the alarm set point, the relay is activated and the LCD displays the alarm condition.

When activated the alarms trigger SPDT Form C non-latching relays @ 5A, 30VDC or 240VAC resistive. To prevent chattering of the relays, a 2% hysteresis is added to the alarm set point. This means that the alarm will remain active until the oxygen reading has fallen 2% below the alarm set point (high alarm) or risen 2% above the alarm set point (low alarm) after the alarm was activated. The timeout feature is useful while replacing the oxygen sensor or during calibration when the oxygen reading might well rise above the alarm set point and trigger a false alarm.

Note: When making connections the user must decide whether to configure/connect Alarm 1 and Alarm 2 in failsafe mode (Normally Open – NO – where the alarm relay de-energizes and closes in an alarm condition) or non-failsafe mode (Normally Closed – NC – where alarm relay energizes and opens in an alarm condition).

Procedure: Advance the cursor (*) to the “Alarm” option and press the green ENTER key to accept the selection.

```
 MAIN MENU          Sample
  Sample
  Span
  Zero
* Alarm             5.00 %
  System
  Standby



Auto Range          0 to 10 %
85ºF      100Kpa    12/31/2011      12:00:00
```

The following menu appears:

```
 ALARM                      Sample
* Set Alarm 1
  Set Alarm 2
  Alarm 1  HI
  Alarm 2  LO
  Alarm 1  ON
  Alarm 2  OFF
  Alarm Timeout


Auto Range                 0 to 10 %
85ºF      100Kpa       12/31/2011      12:00:00
```

Advance the cursor (*) to the “Set Alarm 1” option and press the green ENTER key to accept the selection.

```
                              Sample
  020 %
  Press UP or DOWN
  to change value
  ENTER to Save
  ESC to Return

   Set Alarm 1 in %


Auto Range                 0 to 10 %
85ºF      100Kpa       12/31/2011      12:00:00
```

Follow selection of set point, press the ENTER key to save the alarm value or ESC to return to the MAIN MENU. Within a few seconds after pressing the ENTER key, the system returns to the MAIN MENU.

Repeat the above steps for “Set Alarm 2”.

Configure Alarm 1 and Alarm 2 as High or Low by advancing the cursor (*) to the desired feature as illustrated below.

```
 ALARM                      Sample
  Set Alarm 1
  Set Alarm 2
* Alarm 1  HI
  Alarm 2  LO
  Alarm 1  ON
  Alarm 2  OFF
  Alarm Timeout


Auto Range                 0 to 10 %
85ºF      100Kpa       12/31/2011      12:00:00
```

Press the ENTER key to toggle between the settings: HI and LO and/or ON and OFF.
Pressing the ENTER key will toggle the selection and the system will return to the MAIN MENU.

ALARM TIMEOUT: The Alarm Timeout feature allows the user to select a “time delay” to prevent the alarm from triggering relay immediately after the alarm condition occurs. The time delay feature allows the user from triggering a false alarm during maintenance or self induces signal spike. In order to enter the time delay, advance the cursor (*) to the “Alarm” option and press the green ENTER key to accept the selection.

```
 MAIN MENU          Sample

  Sample
  Span
  Zero
* Alarm             5.00 %
  System
  Standby




Auto Range          0 to 10 %
85ºF      100Kpa    12/31/2011     12:00:00
```

The following menu appears:

```
 ALARM                Sample

 *Set Alarm 1
  Set Alarm 2
  Alarm 1  HI
  Alarm 2  HI
  Alarm 1  ON
  Alarm 2  ON
  Alarm Timeout



Auto Range            0 to 10 %
85ºF      100Kpa      12/31/2011    12:00:00
```

Advance the cursor (*) to the “Alarm Timeout” option and press the green ENTER key to accept the selection.
The following menu appears:

```
                        Sample

  00 MIN

  Press UP or DOWN
  to change value
  ENTER to Save
  ESC to Return

  Alarm Delay in Minutes

Auto Range            0 to 10 %
85ºF      100Kpa      12/31/2011    12:00:00
```

Follow the prompt above and press the ENTER key to save the alarm timeout value or ESC to return to the MAIN MENU.
Within a few seconds after pressing the ENTER key, the system returns to the MAIN MENU.

System Menu

The analyzer is equipped with a wide range of features that enables users to enhance performance and tailor their interface with the analyzer. The SYSTEM menu shown below lists the features available and is followed by a description of each function. Most of the functions are initiated by toggling between options by pressing the ENTER key as previously described.

Advance the cursor (*) to the “Alarm” option and press the green ENTER key to accept the selection.

```
 MAIN MENU          Sample

  Sample
  Span
  Zero
  Alarm             5.00 %
* System
  Standby




Auto Range          0 to 10 %
85ºF      100Kpa    12/31/2011      12:00:00
```

The following menu appears:

```
* SYSTEM

  Enable Low Flow Alarm
  Disable Alarm During Cal
  Signal Average
  Range
  Logging Interval
  Temp Coefficient
  View Data Graph
  Set Clock (and Date)
  Logging  ON
  Show Text
  Display Negative (Reading)  ON
```

Advance the cursor (*) to the desired option, press ENTER key and follow the instructions below.

Enable Low Flow Alarm	If the analyzer is equipped with a low flow alarm, press ENTER key to toggle between ENABLE and DISABLE (this feature is currently not controlled by the microprocessor).
Disable Alarm During Cal	Press ENTER key to toggle between ENABLE and DISABLE.
Signal Average	Press ENTER key to select and choose Low, Medium (default) or High – functions allows users to select their preference regarding the trade-off of response time vs. noise filtering. The signal averaging is roughly 5, 8 and 10 seconds when selecting LOW, MEDIUM OR HIGH option
Range	Same as Auto/Manual Range option found on SAMPLE menu.
Logging Interval	Press ENTER key and a display appears similar to Alarm Timeout above for the user to enter the interval in minutes for capturing data points for logging purposes.

Temp Coefficient	Enables the user to fine tune the temperature compensation (this feature is an option, consult factory for more details).
View Data Graph	Provided that the “Logging” feature is toggled ON, selecting this feature provides a full-screen display or graph of the data points in the analyzer memory.
Set Clock (and Date)	Selecting this option generates a display for selecting Time or Date with each followed by a detailed display for setting hour, minute, second or year, month, day.
Logging	Press ENTER key to toggle between ON and OFF. With Logging ON, the analyzer will store the data in its internal memory. The internal memory is limited to 32K. The total number data points that can be stored are 5500. Depending on the time interval between the points selected, the data can be stored from a few days to several weeks.
Show Text	Press ENTER key to toggle between “Text and Graph” display options: 1.) With Show Text option, large numbers of gas concentration (as illustrated herein) 2.) Show Graph option, small numbers and a small graphical trend of O2 reading. The Graph only shows a limited number of data points. After the graph has filled the limited space on the LCD, the graph will refresh itself by “First in First out” methodology. This feature allows the user to look at trending of the data when installing a new sensor, after calibration or after a process upset condition.
Display Negative (Reading)	Press the ENTER key to toggle between ON and OFF. With “Display Negative” ON, the analyzer will show negative numbers on the screen in the event sensor shows a negative reading.

Installation & Start-up is now complete . . . Proceed to calibrate the Analyzer

The electrochemical oxygen sensors manufactured by Analytical Industries Inc. (dba Advanced Instruments) generate an electrical current that is **linear** or proportional to the oxygen concentration in the sample gas. In the absence of oxygen the sensor exhibits an **absolute zero**, e.g. the sensor does not generate a current output in the absence of oxygen. Given the properties of linearity and an absolute zero, single point calibration is possible.

As described below, zero calibration is recommended only when the application (or user) demands optimum accuracy for analysis below 5% of the most sensitive or lowest range available on the analyzer. Span calibration in one of the forms described below is sufficient for all other measurements.

Zero Calibration

Despite the absolute zero inherent in electrochemical oxygen sensors, the reality is that analyzers can display an oxygen reading when sampling a zero gas due to:

- Contamination or quality of the zero gas
- Minor leakage in the sample line connections
- Residual oxygen dissolved in the sensor's electrolyte
- Tolerances of the electronic components

The zero capability of every analyzer is qualified prior to shipment. However, because the factory sample system conditions differ from that of the user, no ZERO OFFSET adjustment is made to the analyzer by the factory

NOTE: zero calibration is recommended only when the application (or user) demands optimum accuracy for analysis below 5% of the most sensitive or lowest range available on the analyzer

Span Calibration

Involves periodically checking and/or adjusting the electronics to the sensor's signal output at a given oxygen standard or a span gas. To minimize error due to ambient temperature variations, span calibration of the analyzer must be done as close as possible to the sampling temperature conditions. The frequency of calibration varies with the application conditions; the degree of accuracy of the measurement required. However, the interval between span calibrations should not exceed one (1) months.

Note: Regardless of the oxygen concentration of the standard used, the span calibration process takes approximately 10-15 minutes

Menu Functions - Zero Calibration

Factory Default Zero:	The feature eliminates any previous zero calibration offset adjustment stored in the analyzer memory. This factory default calibration is recommended before performing a ZERO CALIBRATION or when troubleshooting the analyzer. The factory default zero calibration is not recommended when subsequent periodic SPAN CALIBRATION is done.
Zero Calibration:	Recommended for optimum accuracy. The user must ascertain that the oxygen reading has reached a stable value and is below 50% of the most sensitive or lowest range available on the analyzer to perform a ZERO CALIBRATION. If the user attempts to initiate the ZERO CALIBRATION function while the oxygen

reading is above 50% of the most sensitive or lowest range, the system displays the message “CALIBRATION FAILED” and returns to the “Sample” mode.

Menu Functions - Span Calibration

Factory Default Span: The system eliminates any previous span calibration adjustment stored in the analyzer memory and displays an oxygen reading within ±50% of the span gas value currently flowing through the analyzer.

If the oxygen reading is outside ±50% of the span gas value, the attempt to perform Span calibration will result in “CALIBRATION FAILED” message and the analyzer will return to the “Sample” mode. This feature allows the user to test the sensor’s signal output without removing it from the sensor housing.

This function is recommended before performing a SPAN CALIBRATION or when troubleshooting an analyzer.

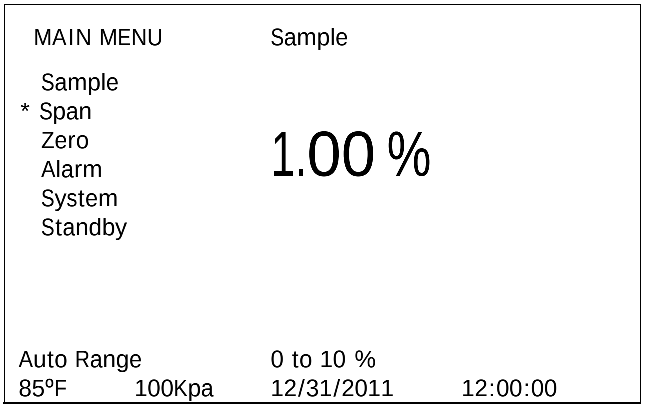
Span Gas Units/Value: After initiating either Auto or Manual Span from the SPAN CALIBRATION menu, the system produces a display prompting the user to select span gas in % units, which is followed by a second display prompting the user to enter a numerical span gas value.

Span Calibration: The user must ascertain that the oxygen reading has reached a stable value before completing Span Calibration. A premature Span calibration will result in inaccurate results.

Calibration Procedure – Span Calibration

To perform Span calibration

1. Assure that the analyzer is in the Auto Range mode as described above.
2. Span gas is connected to the SPAN IN port at the rear of the analyzer (optional feature). If a separate span port is not available, disconnect the sample gas line and connect the span gas line
3. Set the span gas pressure between 5-30 PSIG and set the flow at 1-2 SCFH
4. Allow the analyzer reading to stabilize before attempting calibration.
5. From Main Menu, Advance the cursor (*) to the “Span” option as illustrated and press the green ENTER key to accept the selection.



```
 MAIN MENU           Sample

  Sample
* Span
  Zero
  Alarm              1.00 %
  System
  Standby



Auto Range           0 to 10 %
85ºF      100Kpa     12/31/2011      12:00:00
```

The following menu appears:

```
  SPAN

* Factory Default
  Calibrate








Auto Range              0 to 10 %
85ºF      100Kpa         1/31/2011      12:00:00
```

Advance the cursor (*) to the Calibrate and then select Manual Span option and press ENTER. The following screen will appear prompting the user to select calibration gas unit. Select %

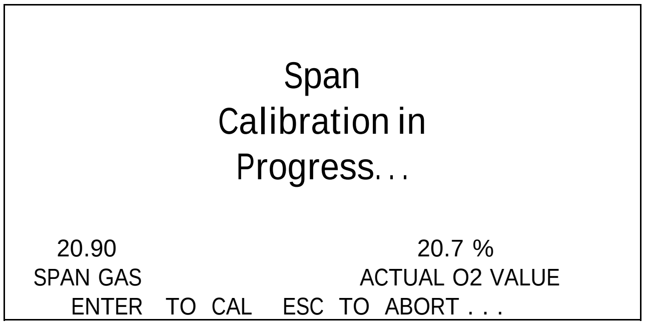
```
 SPAN GAS

* Enter as %








Auto Range              0 to 1%
85ºF      100Kpa         12/31/2011      12:00:00
```

After selecting the calibration gas units, following screen will appear; the analyzer will switch to the appropriate range depending on the span gas value entered.

```
  20.90 %



   Press UP or DOWN keys to change values

   Select ENTER to save, ESC to return to previous digit



Auto Range              0 to 25 %
85ºF      100Kpa         12/31/2011      12:00:00
```

After accepting the span gas value, the display will show the following message
Opening Span valve and then will purge the span line for 30 sec (this is a built in feature for purging the sapn gas line whether a separate span port is available or not (applies to analyzers with sample system equipped with auto/pneumatic sample/span/zero valves) .

Note: When span valve opens, assure that the gas flow is the same as was set for Sample gas. Further, the analyzer might show positive spike on the signal due to excessive oxygen in the span gas line (due to minor leakage in the gas line, oxygen from air diffuses into the gas line even though the span gas line is under pressure) but within a few minutes the excessive oxygen will purge out of the system and the analyzer will begin to analyze the true oxygen content of the span gas.



Span
Calibration in
Progress. . .

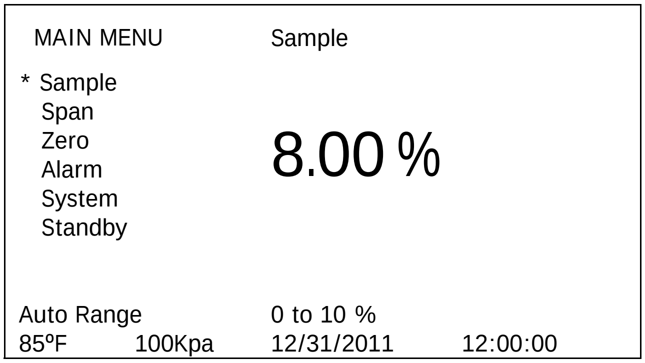
20.90 20.7 %
SPAN GAS ACTUAL O2 VALUE
ENTER TO CAL ESC TO ABORT . . .

After the oxygen reading has stabilized, press ENTER to complete the Span Calibration (if Manual Span option was selected). If the user attempts to complete the SPAN CALIBRATION function while the oxygen reading is outside the +/-50% of the span gas value entered, the system displays the message "CALIBRATION FAILED" and returns to the "Sample" mode.

Auto Span Calibration

In the Auto Span mode, the micro processor will watch the trending of the oxygen reading. When the reading has stabilized and is within +/-50% of the span gas value entered, the micro will adjust the oxygen reading to match with the span gas value and return to the Sample mode and start displaying the true oxygen reading in the sample gas. The Auto Calibration process may take from a few minutes to more than an hour (depending on the level of oxygen contamination of the span gas line).

After completing the Auto Calibration, the system returns to the MAIN MENU in the "Sample" mode and displays the real time oxygen contents in the sample gas. The oxygen value will slowly trend down from the span gas value.



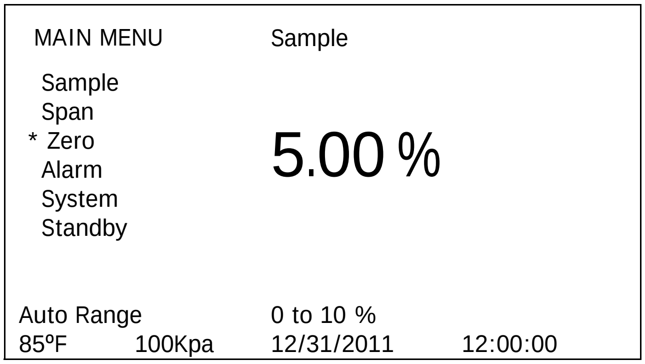
MAIN MENU Sample
* Sample
Span
Zero
Alarm
System
Standby
8.00 %
Auto Range 0 to 10 %
85ºF 100Kpa 12/31/2011 12:00:00

Calibration Procedure – Zero Calibration

To perform Zero calibration

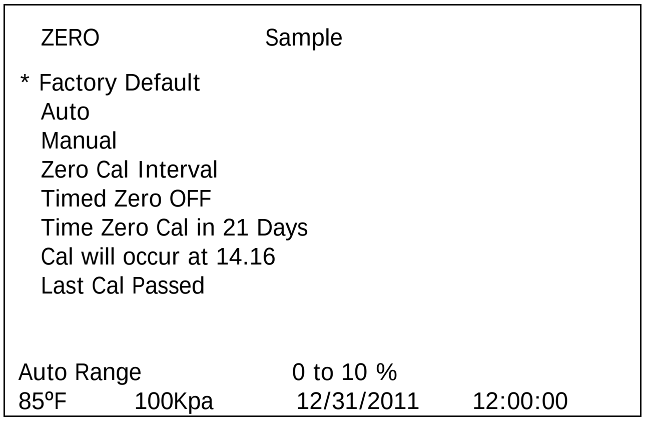
1. Ensure that the analyzer is in the Auto Range mode as described above.
2. Ensure a good quality Zero gas is flowing through the analyzer.
3. Assure there are no restrictions in vent line.
4. Regulate the Zero gas pressure between 5-30 PSIG and set the flow rate to 1-2 SCFH.
5. Allow the analyzer reading to stabilize below 50% of the lowest range available on the analyzer before attempting Zero calibration.

Advance the cursor (*) to the “Zero” option as illustrated and press the green ENTER key to accept the selection.



```
 MAIN MENU          Sample

  Sample
  Span
 * Zero
  Alarm             5.00 %
  System
  Standby


Auto Range          0 to 10 %
85ºF      100Kpa    12/31/2011      12:00:00
```

The following menu appears:

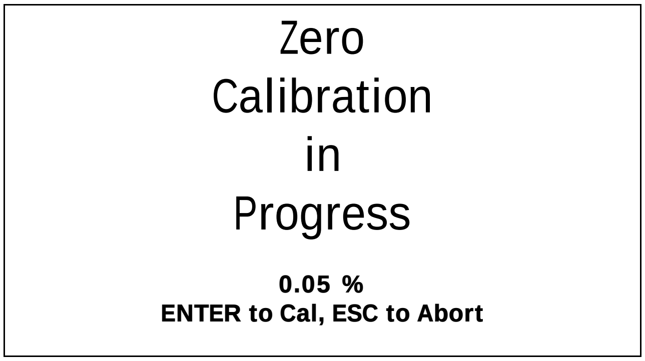


```
  ZERO               Sample

* Factory Default
  Auto
  Manual
  Zero Cal Interval
  Timed Zero OFF
  Time Zero Cal in 21 Days
  Cal will occur at 14.16
  Last Cal Passed


Auto Range            0 to 10 %
85ºF      100Kpa      12/31/2011     12:00:00
```

Advance the cursor (*) to the Auto or Manual Zero option and press ENTER. The microprocessor will open/energize the Zero gas solenoid valve and allow the Zero gas to flow through the analyzer (analyzers equipped with pneumatic sample/span/zero valves). For analyzers without pneumatic valves, allow the zero gas to flow through the analyzer.

Advance the cursor (*) to the “Manual Zero” option and press the green ENTER key to accept the selection.

The following menu with current oxygen value appears:



```
          Zero
       Calibration
           in
        Progress

         0.05 %
ENTER to Cal, ESC to Abort
```

After the oxygen reading has stabilized, press ENTER to complete the Zero Calibration (if Manual Zero option was selected). If the user attempts to initiate the ZERO CALIBRATION function while the oxygen reading is above 50% of the most sensitive or lowest range, the system displays the message “CALIBRATION FAILED” and returns to the

"Sample" mode. In the Auto Zero mode, the micro processor will watch the trending of the oxygen reading. When the reading has stabilized and is within 50% of the allowed limit, the micro will offset the oxygen reading and return to the Sample mode and display the true oxygen reading.

After Zero calibration, the "CALIBRATION FAILED or CALIBRATION PASSED" message will appear.

Note: With Auto calibration routine, the micro processor will watch the downward trend and wait until the change in slope of the downward trend approaches zero (no further drop in the oxygen reading).

NOTE: Zero calibration will pass only if the zero offset had reached less than 50% of the most sensitive range. If the zero offset remains above the 50% of the most sensitive range (but the downward trend had stabilized), the Zero calibration will fail and the analyzer will return to the Sample mode. A message "Failed Cal" will appear on the main display.

AII Configuration Software

AII Configuration Software is available to access all analyzer functions through a PC via a USB connection. This software can be used to perform Zero and Span calibration, select ranges, set alarms and so on. Should you need this software, contact factory.

Analog Output Adjustment

Although the analog signal output (0-1 V or 4-20 mA) has been tested and matches the analyzer display, in rare cases, the analog signal output may not match with the analyzer display. However, the analog signal output may be adjusted in the field by using ***AII Configuration Software***, available free of charge. The configuration software must be installed on a PC and connected to the USB port of the analyzer to make analog signal output adjustment. A procedure to use the configuration software is provided with the software. Should you need a copy, consult factory.

Normal Sampling

After installation and calibration is complete, select the Sample from the main Menu. Choose the Auto or Manual range option. The analyzer will immediately begin to analyze the gas sample and display the real time oxygen concentration on the screen.

When switching sample gas streams, a sudden spike in the analyzer signal might appear. Allow sufficient time to the analyzer to stabilize before starting to collect the real time analysis data. The analyzer data may be stored in the internal analyzer memory or recorded on a recording device by using the 0-1V or 4-20 mA analog signal. When connecting the analog output to an external recording device, limit the length of cable to less than 6 feet. If possible, use a shielded cable with the shield connected to the ground of the recording device.

Standby

- The analyzer has no special storage requirements.
- The sensor should remain inside of the sensor housing and connected with the analyzer electronics during storage periods.
- Turn the Sample/Bypass valve to Bypass position
- Store the analyzer with the power OFF.
- If storing for an extended period of time, protect the analyzer, cable and the sensor housing (with external sensor option) from dust, excessive heat (no more than 45 degree C) and moisture (non condensing atmosphere).

6. Maintenance

There are no moving parts in the analyzer given the modular nature of the electronics and sensor. Cleaning the electrical contacts when replacing the sensor is the extent of the maintenance required.
Serviceability: Except for replacing the oxygen sensor, there are no parts inside the analyzer for the operator to service. Only trained personnel with the authorization of their supervisor should conduct maintenance.

Sensor Replacement
Periodically, the oxygen sensor will require replacement. The operating life is determined by a number of factors that are influenced by the user and therefore difficult to predict. The sections dealing with Specification and Installation Considerations define the normal operating conditions and expected life of the standard sensor utilized by the GPR-2600 analyzer. As a general guideline, expected sensor life is inversely proportional to changes in oxygen concentration, pressure and temperature.

The signal output of a PPM sensor (GPR-11-32-4 OR XLT-12-24-) in air ranges from 40 uA to 55 uA. You may check the sensor output of a sensor by using an ammeter (set ammeter in the micro-amp mode and connect the com of the meter to the inner gold contact and the mA/uA of the meter to the outer gold contact at the back of the sensor). If the output of the sensor in air is not within the expected range, do not install the sensor. Install a new sensor and send the defective sensor to factory for warranty evaluation.

Caution: DO NOT open the oxygen sensor. The sensor contains a corrosive liquid electrolyte that could be harmful if touched or ingested, refer to the Material Safety Data Sheet contained in the Owner’s Manual appendix. Avoid contact with any liquid or crystal type powder in or around the sensor or sensor housing, as either could be a form of electrolyte. Leaking sensors should be disposed of in accordance with local regulations.

7. Spare Parts

Recommended spare parts for the GPR-2600 Oxygen Analyzer include:

Item No.	Description
GPR-11-32-4	% Oxygen Sensor
XLT-11-24-4	% Oxygen Sensor for Sample containing CO2
GPR-11-32	% oxygen sensor with optional sensor with SS housing
XLT-11-24	% oxygen sensor with optional sensor with SS housing for sample with CO2

Other spare parts:

A-3015	Flow Through SS Housing
CTRL-1004	Controller Temperature PID
HTR-1002	Heater 110VAC
HTR-1003	Heater 220VAC
MTR-1008	Meter Digital Panel LCD Backlight
A-1146-E-40	PCB Assembly Main / Display
A-1147-E-40	PCB Assembly Power Supply
A-1174-40C	PCB Assembly Power Supply with Dry contacts as Range ID
SNSR-1006	RTD Temperature Sensor
SNSR-1002	Thermal Runaway Protector J-2 Sensor

8. Troubleshooting

Symptom	Possible Cause	Recommended Action
Slow recovery	1. At installation, sensor was exposed to air for too long.	1. Replace sensor
	2. Defective sensor	2. If recovery unacceptable or O_2 reading fails to reach 50% of lowest range after 48-72 hours of installation of sensor, check gas connections and gas integrity before replacing sensor again
	3. excessive, dead volume in sample line	3. Leak test the entire sample system:
	4. contaminated sample gas due to leakage in sample line connections	4. Vary the flow rate (1-5 SCFH); O_2 reading that changes inversely to the changes in flow rate indicates a leakage in the sample system bringing gas to the analyzer
	5. Sensor damaged in service due to prolonged exposure to air or electrolyte leakage	5. Correct source of leak
	6. Sensor nearing end of life	6. Replace sensor
90 % Response time slow	1. Increased dead legs or distance of sample line	1. Reduce dead volume by reducing sample tube length
	2. low flow rate	2. Increase flow rate
O2 reading doesn’t agree with expected O2 values	1. Pressure and temperature of the sample is varying	1. Calibrate the analyzer at the sample temperature, pressure and flow.
	2. Abnormality in sample gas	2. Confirm O2 contents of sample gas Consult factory
	3. Liquid covering sensing area of sensor	3. Clean sensor's sensing surface
	4. Presence of interference gases	4. Replace sensor, contact factory for sample conditioning
	5. Unauthorized maintenance done	5. Contact factory
	6. Sensor nearing end of life	6. Replace sensor
Erratic, negative or no O2 reading possibly accompanied by electrolyte leakage	1. Pressurizing the sensor by flowing gas to the sensor with the vent restricted and suddenly removing the restriction draws a vacuum on the sensor, causing electrolyte leakage	Replace sensor
	2. Contaminated sample or exhausted O2 sensor	Replace sensor, condition sample gas

O2 reading drifts slowly upward	1. Sensor is nearing end of its useful life	1. Replace sensor
span requires large gain adjustment	1. Low sensor output signal possibly due to moisture condensation on sensor from liquid in sample gas or electrolyte leakage from sensor	1. Ensure there is no condensable moisture in the sample gas. Flow sample gas for 2-3 hours to flush moisture from sample system
	2. Presence of interference gases, e.g., ,$Cl_{2.}$ HCl, H2S	2. Consult factory
O2 reading swings too much with minor variation in ambient temperature	Software bug	Contact factory
The O2 reading freezes even though O2 in sample is changing.	Software bug	Contact factory
No O2 reading with known O2 sample gas.	Defective O2 sensor	Replace O2 sensor
“SENSOR” message appears after Span calibration	Sensor output below the recommended range	Replace sensor

9. Warranty

The design and manufacture of GPR Series oxygen analyzers, monitors and oxygen sensors are performed under a certified Quality Assurance System that conforms to established standards and incorporates state of the art materials and components for superior performance and minimal cost of ownership. Prior to shipment every analyzer is thoroughly tested by the manufacturer and documented in the form of a Quality Control Certification that is included in the Owner's Manual accompanying every analyzer. When operated and maintained in accordance with the Owner's Manual, the units will provide many years of reliable service.

Coverage

Under normal operating conditions, the monitor, analyzers and sensor are warranted to be free of defects in materials and workmanship for the period specified in accordance with the most recent published specifications, said period begins with the date of shipment by the manufacturer. The manufacturer information and serial number of this analyzer are located on the rear of the analyzer. Advanced Instruments Inc. reserves the right in its sole discretion to invalidate this warranty if the serial number does not appear on the analyzer.

If your Advanced Instruments Inc. monitor, analyzer and/or oxygen sensor is determined to be defective with respect to material and/or workmanship, we will repair it or, at our option, replace it at no charge to you. If we choose to repair your purchase, we may use new or reconditioned replacement parts. If we choose to replace your Advanced Instruments Inc. analyzer, we may replace it with a new or reconditioned one of the same or upgraded design. This warranty applies to all monitors, analyzers and sensors purchased worldwide. It is the only one we will give and it sets forth all our responsibilities. There are no other express warranties. This warranty is limited to the first customer who submits a claim for a given serial number and/or the above warranty period. Under no circumstances will the warranty extend to more than one customer or beyond the warranty period.

Limitations

Advanced Instruments Inc. will not pay for: loss of time; inconvenience; loss of use of your Advanced Instruments Inc. analyzer or property damage caused by your Advanced Instruments Inc. analyzer or its failure to work; any special, incidental or consequential damages; or any damage resulting from alterations, misuse or abuse; lack of proper maintenance; unauthorized repair or modification of the analyzer; affixing of any attachment not provided with the analyzer or other failure to follow the Owner's Manual. Some states and provinces do not allow limitations on how an implied warranty lasts or the exclusion of incidental or consequential damages, these exclusions may not apply.

Exclusions

This warranty does not cover installation; defects resulting from accidents; damage while in transit to our service location; damage resulting from alterations, misuse or abuse; lack of proper maintenance; unauthorized repair or modification of the analyzer; affixing of any label or attachment not provided with the analyzer; fire, flood, or acts of God; or other failure to follow the Owner's Manual.

Service

Call Advanced Instruments Inc. at 909-392-6900 (or e-mail info@aii1.com) between 7:30 AM and 5:00 PM Pacific Time Monday thru Thursday or before 12:00 pm on Friday. Trained technicians will assist you in diagnosing the problem and arrange to supply you with the required parts. You may obtain warranty service by returning you analyzer, postage prepaid to:

Advanced Instruments Inc.
2855 Metropolitan Place
Pomona, Ca 91767 USA

Be sure to pack the analyzer securely. Include your name, address, telephone number, and a description of the operating problem. After repairing or, at our option, replacing your Advanced Instruments Inc. analyzer, we will ship it to you at no cost for parts and labor.

10. MSDS Material Safety Data Sheet

Product Identification

Product Name	Oxygen Sensor Series - PSR, GPR, AII, XLT
Synonyms	Electrochemical Sensor, Galvanic Fuel Cell
Manufacturer	Analytical Industries Inc., 2855 Metropolitan Place, Pomona, CA 91767 USA
Emergency Phone Number	909-392-6900
Preparation / Revision Date	January 1, 1995
Notes	Oxygen sensors are sealed, contain protective coverings and in normal conditions do not present a health hazard. Information applies to electrolyte unless otherwise noted.

Specific Generic Ingredients

Carcinogens at levels > 0.1%	None
Others at levels > 1.0%	Potassium Hydroxide or Acetic Acid, Lead
CAS Number	Potassium Hydroxide = KOH 1310-58-3 or Acetic Acid = 64-19-7, Lead = Pb 7439-92-1
Chemical (Synonym) and Family	Potassium Hydroxide (KOH) – Base or Acetic Acid (CH_3CO_2H) – Acid, Lead (Pb) – Metal

General Requirements

Use	Potassium Hydroxide or Acetic Acid - electrolyte, Lead - anode
Handling	Rubber or latex gloves, safety glasses
Storage	Indefinitely

Physical Properties

Boiling Point Range	KOH = 100 to 115° C or Acetic Acid = 100 to 117° C
Melting Point Range	KOH -10 to 0° C or Acetic Acid – NA, Lead 327° C
Freezing Point	KOH = -40 to -10° C or Acetic Acid = -40 to -10° C
Molecular Weight	KOH = 56 or Acetic Acid – NA, Lead = 207
Specific Gravity	KOH = 1.09 @ 20° C, Acetic Acid = 1.05 @ 20° C
Vapor Pressure	KOH = NA or Acetic Acid = 11.4 @ 20° C
Vapor Density	KOH – NA or Acetic Acid = 2.07
pH	KOH > 14 or Acetic Acid = 2-3
Solubility in H_2O	Complete
% Volatiles by Volume	None
Evaporation Rate	Similar to water
Appearance and Odor	Aqueous solutions: KOH = Colorless, odorless or Acetic Acid = Colorless, vinegar-like odor

Fire and Explosion Data

Flash and Fire Points	Not applicable
Flammable Limits	Not flammable
Extinguishing Method	Not applicable
Special Fire Fighting Procedures	Not applicable
Unusual Fire and Explosion Hazards	Not applicable

Reactivity Data

Stability	Stable
Conditions Contributing to Instability	None
Incompatibility	KOH = Avoid contact with strong acids or Acetic Acid = Avoid contact with strong bases
Hazardous Decomposition Products	KOH = None or Acetic Acid = Emits toxic fumes when heated
Conditions to Avoid	KOH = None or Acetic Acid = Heat

Spill or Leak

Steps if material is released	Sensor is packaged in a sealed plastic bag, check the sensor inside for electrolyte leakage. If the sensor leaks inside the plastic bag or inside an analyzer sensor housing do not remove it without rubber or latex gloves and safety glasses and a source of water. Flush or wipe all surfaces repeatedly with water or wet paper towel (fresh each time).

Disposal	In accordance with federal, state and local regulations.

Health Hazard Information

Primary Route(s) of Entry	Ingestion, eye and skin contact
Exposure Limits	Potassium Hydroxide - ACGIH TLV 2 mg/cubic meter or Acetic Acid - ACGIH TLV / OSHA PEL 10 ppm (TWA), Lead - OSHA PEL .05 mg/cubic meter
Ingestion	Electrolyte could be harmful or fatal if swallowed. KOH = Oral LD50 (RAT) = 2433 mg/kg or Acetic Acid = Oral LD50 (RAT) = 6620 mg/kg
Eye	Electrolyte is corrosive and eye contact could result in permanent loss of vision.
Skin	Electrolyte is corrosive and skin contact could result in a chemical burn.
Inhalation	Liquid inhalation is unlikely.
Symptoms	Eye contact - burning sensation. Skin contact - soapy slick feeling.
Medical Conditions Aggravated	None
Carcinogenic Reference Data	KOH and Acetic Acid = NTP Annual Report on Carcinogens - not listed; LARC Monographs - not listed; OSHA - not listed
Other	Lead is listed as a chemical known to the State of California to cause birth defects or other reproductive harm.

Special Protection Information

Ventilation Requirements	None
Eye	Safety glasses
Hand	Rubber or latex gloves
Respirator Type	Not applicable
Other Special Protection	None

Special Precautions

Precautions	Do not remove the sensor’s protective Teflon and PCB coverings. Do not probe the sensor with sharp objects. Wash hands thoroughly after handling. Avoid contact with eyes, skin and clothing. Empty sensor body may contain hazardous residue.
Transportation	Not applicable